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Draft Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation FY04 Notification #04-13 IHSS Group 900-12, East Trenches

April 2004

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Draft Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation FY04 Notification #04-13 IHSS Group 900-12, East Trenches

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Draft Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation FY04 Notification #04-13 IHSS Group 900-12, East Trenches

Approval received from the U.S. Environmental Protection Agency, Region 8

( ).

Approval letter contained in the Administrative Record.

April 2004

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ACRONYMS

AL	action level
BMP	best management practice
BZ	Buffer Zone
BZSAP	Buffer Zone Sampling and Analysis Plan
CDPHE	Colorado Department of Public Health and Environment
COC	contaminant of concern
cy	cubic yard
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EDDIE	Environmental Data Dynamic Information Exchange
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ER RSOP	Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation
FY	Fiscal Year
IA	Industrial Area
IHSS	Individual Hazardous Substance Site
ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
nCi/g	nanocuries per gram
NFAA	No Further Accelerated Action
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PDF	portable document format
POC	Point of Compliance
POE	Point of Evaluation
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFCA or Site	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RSOP	RFCA Standard Operating Protocol
SAP	Sampling and Analysis Plan
SID	South Interceptor Ditch
SSRS	Subsurface Soil Risk Screen
SVOC	semi-volatile organic compound
VOC	volatile organic compound
WRW	wildlife refuge worker

1.0 INTRODUCTION

This Environmental Restoration (ER) Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) for Routine Soil Remediation (ER RSOP) (DOE 2003a) Fiscal Year (FY) 04 Notification includes the notification to remediate Individual Hazardous Substance Sites (IHSSs) at the Rocky Flats Environmental Technology Site (RFETS or Site) Buffer Zone (BZ) during FY04. The purpose of this Notification is to invoke the ER RSOP for IHSS Group 900-12. Activities specified in the ER RSOP are not reiterated here; however, deviations from the ER RSOP are included where appropriate.

Soil with contaminant concentrations greater than the RFCA action levels (ALs), or as indicated by the Subsurface Soil Risk Screen (SSRS), and associated debris will be removed in accordance with RFCA (DOE et al. 2003) and the ER RSOP (DOE 2003a).

IHSS Group 900-12 is shown on Figure 1. The potential remediation areas covered under ER RSOP Notification #04-13 are listed in Table 1.

Table 1
Potential Remediation Areas for IHSS Group 900-12

IHSS Group	IHSS	COCs	Media	Estimated Remediation Volume
900-12	NE-111.3, Trench T-6	Radionuclides, Metals, VOCs, SVOCs, and PCBs	Surface and subsurface soil and associated debris	<10 cy
900-12	NE-111.5, Trench T-8	Radionuclides, Metals, VOCs, SVOCs, and PCBs	Surface and subsurface soil and associated debris	<10 cy

VOCs – volatile organic compounds
SVOCs – semi-volatile organic compounds
PCBs – polychlorinated biphenyls

Five other trenches are present within IHSS Group 900-12 and are not addressed in this Notification. Trenches T-5 (IHSS NE-111.2), T-10 (IHSS NE-111.7), and T-11 (IHSS NE-111.8) will be recommended for NFAA in a separate data summary report. Trenches T-9a and T-9b (IHSS NE-111.6a & b) will be recommended for NFAA in the closeout report that will also address Trenches T-6 and T-8.

2.0 IHSS GROUP 900-12

IHSS Group 900-12 consists of seven trenches (six IHSSs) mentioned in Section 1.0. Contaminants of concern (COCs) at IHSS Group 900-12 are listed in Table 1. The COCs were determined based on process knowledge and data collected during previous studies (DOE 1992-2003, 1996, 2001, 2002a and 2003b).

2.1 Project Conditions

Historical and accelerated action soil characterization data for Trenches T-6, T-8, T-9a and T-9b are presented on Figures 2 and 3, respectively. Only data greater than background means plus two standard deviations or method detection limits/reporting limits are presented. Accelerated action characterization activities were planned and executed in accordance with the BZ Sampling and Analysis Plan (SAP) (BZSAP) (DOE 2002a) and BZSAP Addendum #BZ-04-02 (DOE 2003b).

Historical data reveal that one americium-241 activity, two plutonium-239/240 activities, and one chromium concentration exceeded the wildlife refuge worker (WRW) ALs at one location within Trench T-8 (Location 12795) (Table 2 and Figure 2). Exceedances occurred below 3 feet from ground surface and were considerably less than 3 nanocuries per gram (nCi/g).

Accelerated action data reveal WRW AL exceedances at three locations within Trenches T-6, T-8 and T-9a (Table 2 and Figure 3). In Trench T-6, plutonium-239/240 activities exceeded the WRW AL at 0 to 1 foot, 1 to 3 feet, and 3 to 5 feet below ground surface. In Trench T-8, plutonium-239/240 activities exceeded the WRW AL at 0 to 1 feet, 1 to 3 feet, 3 to 5 feet, and 5 - 7 feet below ground surface. Americium-241 activities exceeded the WRW AL at 1 to 3 feet and 3 to 5 feet. In Trench T-9a, the benzo(a)pyrene concentration exceeded the WRW AL at 1 to 3 feet below ground surface. All plutonium activities were considerably less than 3 nCi/g.

Table 2
WRW AL Exceedances Within Trenches T-6, T-8 and T-9a

Trench	Sampling Location	Depth (ft)	Analyte	Result	WRW AL	Unit
T-6	DA41-001	0 - 1	Plutonium-239/240	237.8	50	pCi/g
T-6	DA41-001	1 - 3	Plutonium-239/240	195.7	50	pCi/g
T-6	DA41-001	3 - 5	Plutonium-239/240	123.2	50	pCi/g
T-8	CZ40-003	0 - 1	Plutonium-239/240	84.6	50	pCi/g
T-8	CZ40-003	1 – 3	Americium-241	132.7	76	pCi/g
T-8	CZ40-003	1 - 3	Plutonium-239/240	756.4	50	pCi/g
T-8	CZ40-003	3 - 5	Americium-241	122.0	76	pCi/g
T-8	CZ40-003	3 - 5	Plutonium-239/240	695.4	50	pCi/g
T-8	CZ40-003	5 - 7	Plutonium-239/240	98.8	50	pCi/g
T-8	12795	3 - 8	Americium-241	104.9	76	pCi/g
T-8	12795	3 - 8	Chromium	4,600	268	mg/kg
T-8	12795	3 – 8	Plutonium-239/240	642.4	50	pCi/g
T-8	12795	8 - 10	Plutonium-239/240	131.4	50	pCi/g
T-9a	CY40-002	1 - 3	Benzo(a)pyrene	4,700	3490	ug/kg

THIS TARGET SHEET REPRESENTS AN
OVER-SIZED MAP / PLATE FOR THIS DOCUMENT:
(Ref: 04-RF-00490; JLB-039-04)

Draft Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation FY04 Notification 04-13 IHSS Group 900-12 East Trenches

April 2004

Figure 2:

Trenches T-6, T-8, T-9a, and T-9b, Existing Data Greater than Background Mean Plus Two Standard Deviations, or Method Detection Limits

File: W:\Projects\Fy2003\Trenches\East Trenches_092503\sub_trenches.apr

~~**January 27, 2004**~~
April 19, 2004

CERCLA Administrative Record Document, BZ-A-000695

U.S. DEPARTEMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

GOLDEN, COLORADO

A

THIS TARGET SHEET REPRESENTS AN
OVER-SIZED MAP / PLATE FOR THIS DOCUMENT:
(Ref: 04-RF-00490; JLB-039-04)

Draft Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation FY04 Notification 04-13 IHSS Group 900-12 East Trenches

April 2004

Figure 2:

Trenches T-6, T-8, T-9a, and T-9b, Accelerated Action Characterization Data Greater than Background Mean Plus Two Standard Deviations, or Reporting Limits

File: W:\Projects\Fy2003\Trenches\East Trenches_092503\sub_trenches.apr

April 19, 2004

CERCLA Administrative Record Document, BZ-A-000695

U.S. DEPARTEMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

GOLDEN, COLORADO

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2.2 RFCA SSRS Evaluation

An SSRS is performed when non-radionuclides and uranium are present in soil below 6 inches from the ground surface, when americium-241 and plutonium-239/240 are present below 3 feet from the ground surface, and for soil beneath below-grade structures. Current site conditions are evaluated to determine whether remediation is required by the SSRS. The SSRS will be conducted again after the accelerated action and related confirmation sampling are completed. The accelerated actions taken, sampling results, and a revised SSRS will be documented in the IHSS Group 900-12 Closeout Report.

Screen 1 – Are contaminant of concern (COC) concentrations less than RFCA Table 3 soil ALs for the WRW?

No. WRW AL exceedances have been detected in subsurface soil within Trenches T-6, T-8 and T-9a, as discussed in Section 2.1 and summarized in Table 2.

Screen 2 – Is there a potential for subsurface soil to become surface soil (landslide and erosion areas identified on Figure 1)?

No. IHSS Group 900-12 is not located in an area prone to erosion and landslides in accordance with Figure 1 of RFCA Attachment 5 (DOE et al. 2003).

Screen 3 – Does subsurface soil contamination for radionuclides exceed criteria defined in RFCA Section 5.3 and Attachment 14?

No. Section 5.3(C)(2) requires the removal of soil in the 3- to 6-foot depth interval that contains plutonium at activities that exceed 3 nCi/g (3,000 picocuries per gram [pCi/g]) with an areal extent of contamination that exceeds 80 square meters. As shown in Table 2, plutonium activities do not exceed 3 nCi/g in any of the trench samples.

Screen 4 – Is there an environmental pathway and sufficient quantity of COCs that would cause an exceedance of the surface water standards?

No. Contaminant migration via erosion and groundwater are the two possible pathways whereby surface water could become contaminated by Trenches T-6, T-8 and T-9a. However, erosion is an insignificant pathway because the trenches are in a flat-lying area not prone to erosion. Runoff from the area flows into the South Interceptor Ditch (SID), via the East Spray Field Interceptor Channel, and then into Pond C-2 (DOE 2003c). Water is monitored upstream of Pond C-2 and prior to discharge from Pond C-2.

With respect to the groundwater pathway, the trenches are located near a hydraulic divide where water may migrate to the north/northeast or to the south/southeast depending on groundwater levels. Most of the time, wells in the vicinity of the trenches, specifically Trenches T-6 and T-8, are dry. In 1992, there was sufficient groundwater in the area for sampling, and samples were collected from nearby wells 8391 and 8591. The samples at these wells contained VOCs at concentrations greater than RFCA groundwater Tier II ALs, but less than RFCA groundwater Tier I ALs. Plutonium-239/240, americium-241, benzo(a)pyrene and chromium (contaminants that exceeded soil WRW ALs) were not detected.

When there is local groundwater and it is flowing to the north/northeast, VOC contamination would be captured by the East Trenches Plume Groundwater Collection

and Treatment System. When there is local groundwater and it is flowing to the south/southeast, any contamination would migrate parallel to the 903 Pad and Ryan's Pit plume. This plume has migrated toward the SID and Woman Creek drainage; however, discharge to surface water has not been observed nor is it expected, most notably due to insufficient saturated thickness and periods of dry conditions (DOE 1999). Additionally, recent groundwater data from two plume extent wells located south and near Trenches T-6 and T-8 (Wells 04591 and 10194) indicate no VOC contamination (DOE 2002b). The two wells contained uranium-233/234 and uranium-238 activities that were greater than RFCA Tier II ALs, but less than background levels.

2.3 Remediation Plan

The RSOP Notification remediation plan for IHSS Group 900-12 includes the following objectives:

- Remove soil with non-radionuclide or uranium contaminant concentrations greater than the RFCA WRW ALs to a depth of 6 inches.
- Remove soil with plutonium-239/240 or americium-241 activities greater than the RFCA WRW AL to a depth of 3 feet, or to less than the applicable AL, whichever comes first.
- Once contaminated soil is removed, collect confirmation soil samples in accordance with the BZSAP (DOE 2002a).

Based on the data presented in Table 2 and the SSRS presented in Section 2.2, remediation will involve removal of the first three feet of soil and debris at Sampling Locations CZ40-003 and DA41-001 (Trenches T-8 and T-6, respectively). The excavations will be 5 feet x 5 feet x 3 feet (2.7 cubic yards). Confirmation samples will be collected at the center of each excavation bottom and the center of each side wall, for a total of 10 samples (1 + 4 samples per excavation x 2 excavations). Samples will be analyzed for radionuclides, metals, VOCs, SVOCs, and PCBs. Potential remediation areas are shown on Figure 4.

In accordance with the SSRS, Sampling Locations 12795 (Trench T-8) and CY40-002 (Trench T-9a) do not require remediation. The benzo(a)pryrene (Location CY40-002), americium-241 (Location 12795), chromium (Location 12795), and plutonium-239/240 (Location 12795) exceedances occur in subsurface soil.

2.4 Stewardship Evaluation

Based on the WRW AL exceedances detected (Table 2) and the ER RSOP (DOE 2003a), portions of Trenches T-6 and T-8 will be remediated (Section 2.3). Figure 4 shows the potential remediation areas (Sampling Locations DA41-001 and CZ40-003 in Trenches T-6 and T-8, respectively).

An additional stewardship evaluation will be performed during remediation using the consultative process and documented in a closeout report for IHSS Group 900-12. A new map of residual contamination will be generated after remediation. The following sections present the stewardship evaluation.

2.4.1 Proximity to Other Contaminant Sources

IHSS Group 900-12 is in the RFETS BZ and is located east of the 903 Pad and the 903 Pad Lip Area, and west of the East Spray Fields.

2.4.2 Surface Water Protection

Surface water protection includes the following considerations:

Is there a pathway to surface water from potential erosion to streams or drainages?

Soil contaminants from IHSS Group 900-12 could migrate to surface water. Runoff from the area flows south into the SID, which discharges into Pond C-2 via Surface Water Monitoring Station SW027 (a RFCA Surface Water Point of Evaluation [POE]) (DOE 2003c). However, erosion in the IHSS Group is not significant (Section 2.2).

Do characterization data indicate there are contaminants in surface soil?

Accelerated action soil characterization data indicate that plutonium activities exceed the RFCA WRW AL (Table 2).

Do monitoring results from POEs or Points of Compliance (POCs) indicate there are surface water impacts from the area under consideration?

The nearest RFCA POE is SW027 (DOE 2003c), and americium-241 and plutonium-239/240 activities have exceeded water quality ALs at this monitoring station. However, most of the annual average americium-241 and plutonium-239/240 activities are less than 0.15 picocurie per liter (pCi/L), and neither of the long-term americium and plutonium averages (Water Year 97 - 01) is greater than 0.15 pCi/L. Also, all of the annual average metal concentrations are less than the ALs, and none of the 30-day averages were reportable. This monitoring station receives water from a large part of the Industrial Area (IA) (IA Areas 400, 600, 800 and 900), and surface water quality at the monitoring station cannot be attributable to any single IHSS Group.

Is the IHSS Group in an area with high erosion potential, based on the 100-Year Average Erosion Map?

IHSS Group 900-12 is not located in an area subject to erosion in accordance with Figure 1 of RFCA Attachment 5 (DOE et al. 2003).

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2.4.3 Monitoring

Monitoring includes the following considerations:

Do monitoring results from POEs or POCs indicate there are groundwater impacts from the area under consideration?

There are groundwater monitoring wells near Trenches T-6 and T-8 (08391 and 08591) as well as plume extent wells south of the two trenches (04591 and 10194). The wells near the two trenches are usually dry. In 1992, there was sufficient groundwater in the area for sampling, and samples were collected. The samples contained VOCs at concentrations greater than RFCA groundwater Tier II ALs, but less than RFCA groundwater Tier I ALs. Plutonium-239/240, americium-241, benzo(a)pyrene and chromium (contaminants that exceeded soil WRW ALs) were not detected. Recent groundwater data from the two plume extent wells indicate no VOC contamination (DOE 2002b). The two wells contained uranium-233/234 and uranium-238 activities that were greater than RFCA groundwater Tier II ALs, but less than background levels.

Can the impact be traced to a specific IHSS Group?

Impacts cannot be definitively traced to IHSS Group 900-12.

Are additional monitoring stations needed?

The need for and placement of monitoring stations will be re-evaluated in the Long-Term Stewardship Plan.

Can existing monitoring locations be deleted if additional remediation is conducted?

Not applicable. Existing wells monitor potential contamination from areas outside IHSS Group 900-12.

2.4.4 Stewardship Actions and Recommendations

The current stewardship actions and recommendations for IHSS Group 900-12 are as follows:

- Use best management practices (BMPs) to reduce erosion into surface water drainage.
- Implement near-term institutional controls until final closure and stewardship decisions are implemented, including the following:
  - Restrict access; and
  - Control soil excavations through the Site Soil Disturbance Permit process.
- Implement long-term stewardship actions, including the following:
  - Prohibitions on construction of buildings;
  - Restrictions on excavations or other soil disturbance; and
  - Prohibitions on groundwater pumping in the area of IHSS Group 900-12.

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These recommendations may change based on in-process remediation activities and other future RFETS remediation decisions.

2.5 Accelerated Action Remediation Goals

ER RSOP remedial action objectives (RAOs) include the following:

- Provide a remedy consistent with the RFETS goal of protection of human health and the environment;
- Provide a remedy that minimizes the need for long-term maintenance and institutional or engineering controls; and
- Minimize the spread of contaminants during implementation of accelerated actions.

2.6 Treatment

Not applicable.

2.7 Project-Specific Monitoring

High-volume air samplers may be used at the remediation area consistent with work controls to determine airborne radioactivity concentrations. Approximate locations of air samplers are shown on Figure 4.

2.8 RCRA Units and Intended Waste Disposition

IHSS Group 900-12 contains no Resource Conservation and Recovery Act (RCRA) units subject to RCRA closure requirements.

2.9 Administrative Record Documents

The following Administrative Record documents pertain to this ER RSOP Notification for IHSS Group 900-12:

DOE, 1992-2003, Historical Release Reports for the Rocky Flats Plant, Golden, Colorado.

DOE, 1996, Draft Trenches and Mound Site Characterization Report, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 1999, 903 Pad/Ryan's Pit Plume Project Completion Report, Fiscal Year 1999, Rocky Flats Environmental Technology Site, Golden, Colorado, August.

DOE, 2001, Rocky Flats Environmental Technology Site Buffer Zone Data Summary Report, Golden, Colorado, July.

DOE, 2002a, Buffer Zone Sampling and Analysis Plan, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

DOE, 2002b, First Quarter RFCA Groundwater Monitoring Report for Calendar Year 2002, Rocky Flats Environmental Technology Site, Golden, Colorado, November.

DOE, 2003a, Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation Modification, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 2003b, Buffer Zone Sampling and Analysis Plan FY04 Addendum #BZ-04-02, Rocky Flats Environmental Technology Site, Golden, Colorado, November.

DOE, 2003c, Automated Surface-Water Monitoring Report, Water Year 2001, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, CDPHE, and EPA, 2003, Modifications to the Rocky Flats Cleanup Agreement Attachment, U.S. Department of Energy, Colorado Department of Public Health and Environment, and U.S. Environmental Protection Agency, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

2.10 Projected Schedule

Remediation of IHSS Group 900-12 is expected to begin in third quarter of FY04.

3.0 PUBLIC PARTICIPATION

ER RSOP Notification #04-13 activities will be discussed at the May 2004 ER/Decontamination and Decommissioning (D&D) status meeting. A portable document format (PDF) version of this Notification was provided to the local governments. This Notification is available at the Rocky Flats Reading Rooms and on the Environmental Data Dynamic Information Exchange (EDDIE) Website at www.rfets.gov.

4.0 REFERENCES

DOE, 1992-2003, Historical Release Reports for the Rocky Flats Plant, Golden, Colorado.

DOE, 1996, Draft Trenches and Mound Site Characterization Report, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 1999, 903 Pad/Ryan's Pit Plume Project Completion Report, Fiscal Year 1999, Rocky Flats Environmental Technology Site, Golden, Colorado, August.

DOE, 2001, Rocky Flats Environmental Technology Site Buffer Zone Data Summary Report, Golden, Colorado, July.

DOE, 2002a, Buffer Zone Sampling and Analysis Plan, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

DOE, 2002b, First Quarter RFCA Groundwater Monitoring Report for Calendar Year 2002, Rocky Flats Environmental Technology Site, Golden, Colorado, November.

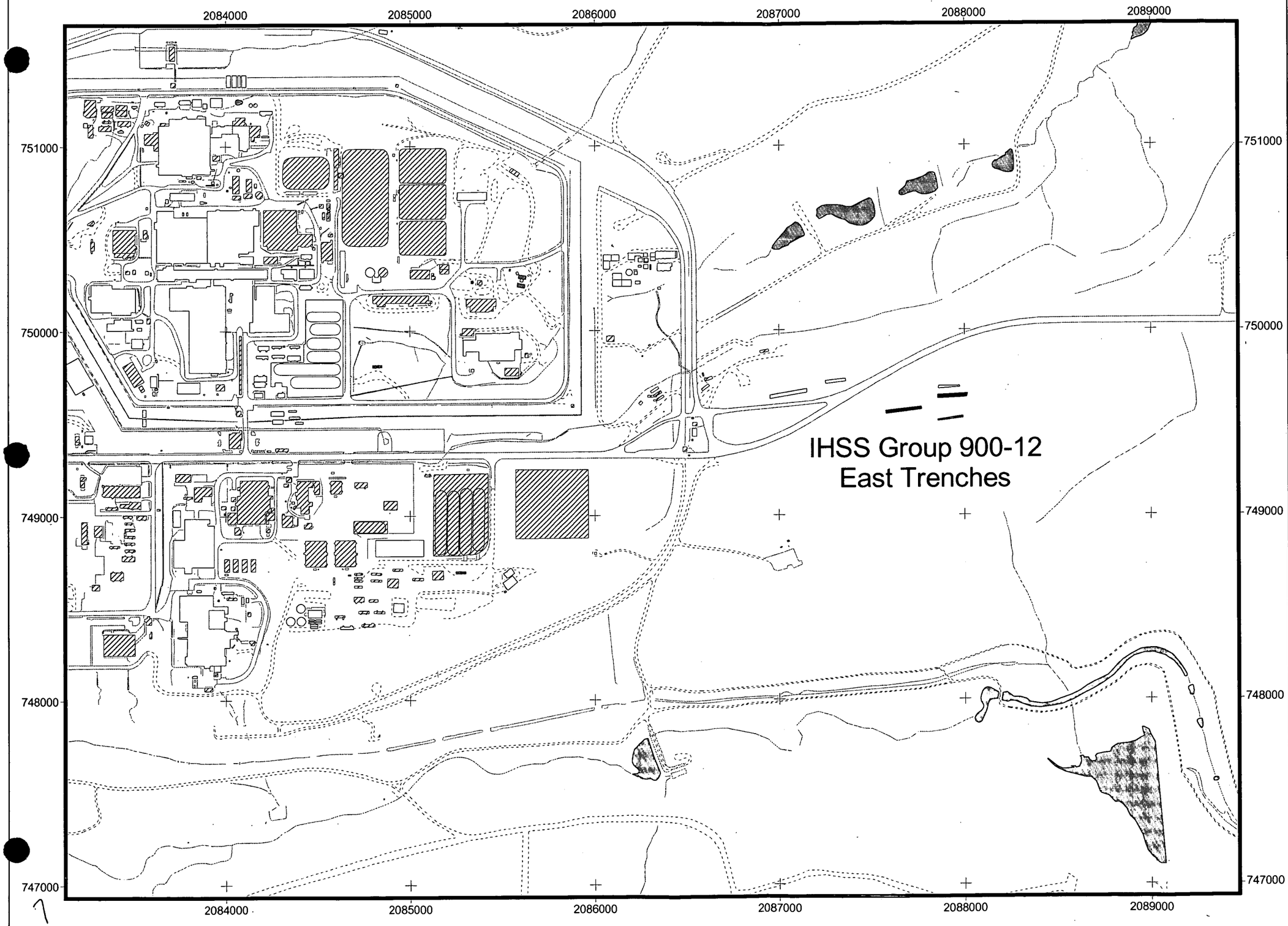
DOE, 2003a, Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation Modification, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, 2003b, Buffer Zone Sampling and Analysis Plan FY04 Addendum #BZ-04-02, Rocky Flats Environmental Technology Site, Golden, Colorado, November.

DOE, 2003c, Automated Surface-Water Monitoring Report, Water Year 2001, Rocky Flats Environmental Technology Site, Golden, Colorado, September.

DOE, CDPHE, and EPA, 2003, Modifications to the Rocky Flats Cleanup Agreement Attachment, U.S. Department of Energy, Colorado Department of Public Health and Environment, and U.S. Environmental Protection Agency, Rocky Flats Environmental Technology Site, Golden, Colorado, June.

Figure 1
IHSS Group 900-12
Location



KEY

- IHSS Group 900-12 trench (characterized as part of accelerated action)
- IHSS Group 900-12 trench (not characterized as part of accelerated action)
- Demolished building
- Standing building
- Paved road
- Dirt road
- Pond
- Stream

N
W E
S

200 0 200 400 600 800 Feet

Scale = 1:6,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

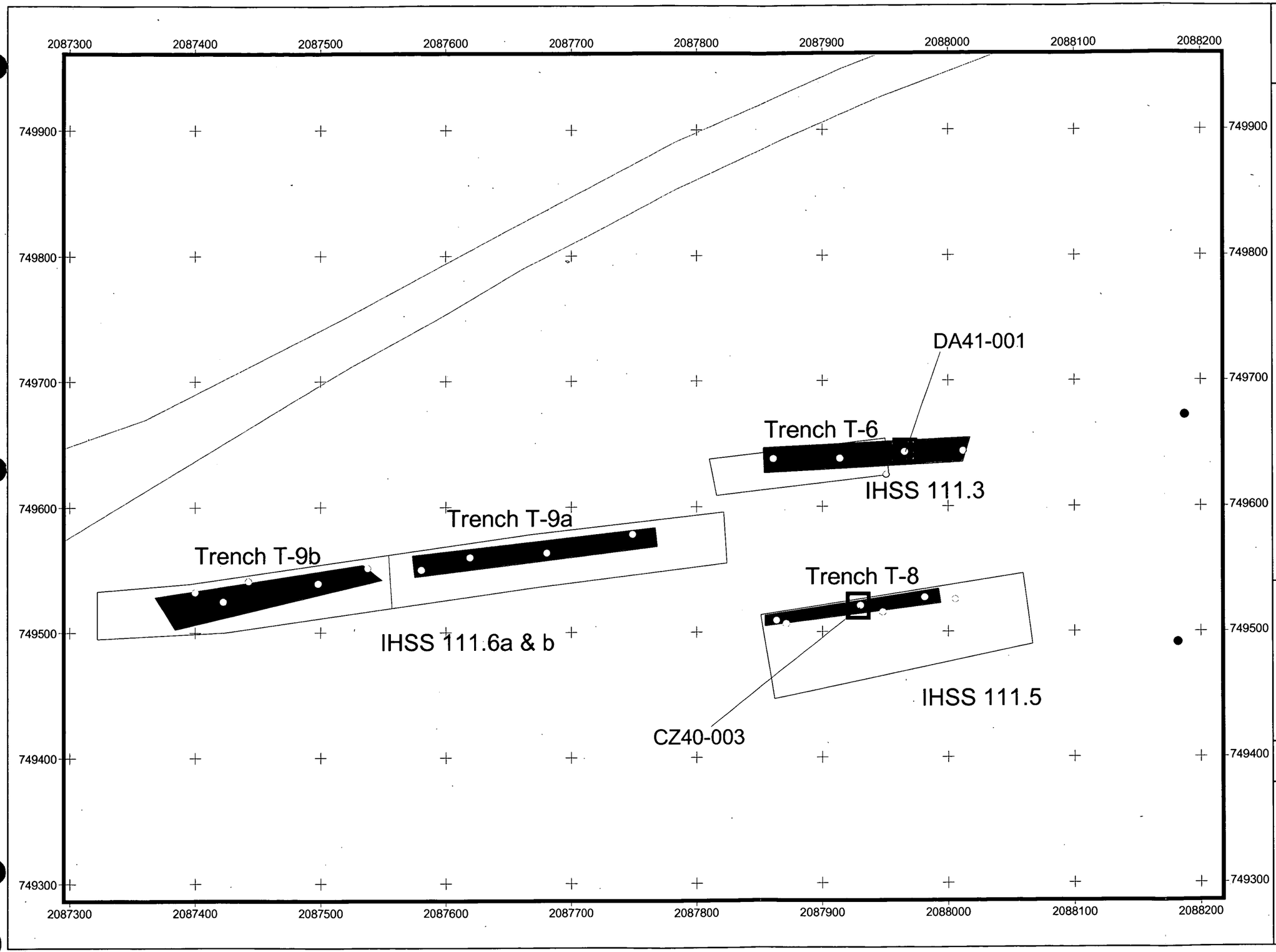
U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: RADMS

Prepared for: KAISER•HILL COMPANY

File: w:\projects\2003\trenches\
east trenches-092503\sub_trench.apr Date: 10/08/03

Figure 4
IHSS Group 900-12
Potential Remediation Areas



KEY

- Sampling Location
- Approximate Location of Air Sampler
- Proposed Remediation Area
- 2003 Updated HRR Trench Boundary
- 2003 Updated HRR IHSS Boundary
- Paved Road

N
W E
S

20 0 20 40 60 80 100 Feet

Scale = 1:900

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: RADMS

Prepared for: KAISER•HILL COMPANY

File: w:\projects\2003\trenches\
east trenches-092503\sub_trench.apr Date: 04/01/04

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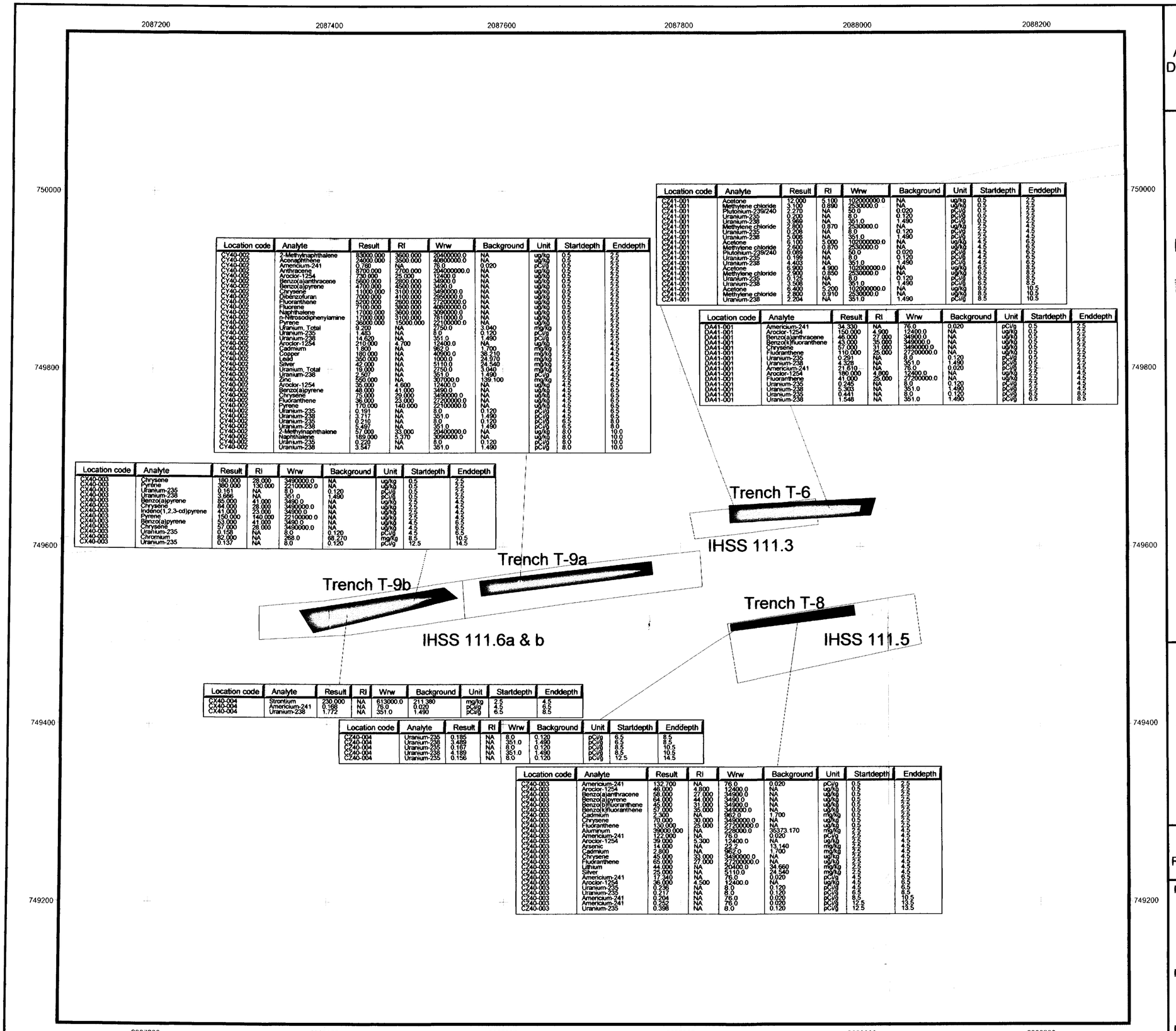

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CY40-002	2-Methylnaphthalene	83000.000	3500.000	20400000.0	NA	ug/kg	0.5	2.5
CY40-002	Acenaphthene	24000.000	3500.000	40800000.0	NA	ug/kg	0.5	2.5
CY40-002	Americium-241	0.781	NA	76.0	0.020	pCi/g	0.5	2.5
CY40-002	Anthracene	8700.000	2700.000	204000000.0	NA	ug/kg	0.5	2.5
CY40-002	Aroclor-1254	730.000	25.000	12400.0	NA	ug/kg	0.5	2.5
CY40-002	Benzo(a)anthracene	5800.000	2800.000	34900.0	NA	ug/kg	0.5	2.5
CY40-002	Benzo(a)pyrene	4700.000	4500.000	3490.0	NA	ug/kg	0.5	2.5
CY40-002	Chrysene	11000.000	3100.000	3490000.0	NA	ug/kg	0.5	2.5
CY40-002	Dibenzofuran	7000.000	4100.000	2550000.0	NA	ug/kg	0.5	2.5
CY40-002	Fluoranthene	5200.000	2600.000	272000000.0	NA	ug/kg	0.5	2.5
CY40-002	Fluorene	7100.000	3800.000	40800000.0	NA	ug/kg	0.5	2.5
CY40-002	Naphthalene	17000.000	3600.000	3090000.0	NA	ug/kg	0.5	2.5
CY40-002	n-Nitrosodiphenylamine	17000.000	3100.000	78100000.0	NA	ug/kg	0.5	2.5
CY40-002	Pyrene	39000.000	15000.000	204000000.0	NA	ug/kg	0.5	2.5
CY40-002	Uranium, Total	9.200	NA	2750.0	3.040	mg/kg	0.5	2.5
CY40-002	Uranium-235	1.483	NA	8.0	0.120	pCi/g	0.5	2.5
CY40-002	Uranium-238	14.620	NA	351.0	1.490	pCi/g	0.5	2.5
CY40-002	Aroclor-1254	210.000	4.700	12400.0	NA	ug/kg	2.5	4.5
CY40-002	Cadmium	1.900	NA	962.0	1.700	mg/kg	2.5	4.5
CY40-002	Copper	180.000	NA	40590.0	36.210	mg/kg	2.5	4.5
CY40-002	Lead	350.000	NA	1000.0	24.570	mg/kg	2.5	4.5
CY40-002	Silver	42.000	NA	5110.0	24.540	mg/kg	2.5	4.5
CY40-002	Uranium, Total	18.000	NA	2750.0	3.040	mg/kg	2.5	4.5
CY40-002	Uranium-238	2.567	NA	351.0	1.490	pCi/g	2.5	4.5
CY40-002	Zinc	550.000	NA	307000.0	139.100	mg/kg	2.5	4.5
CY40-002	Aroclor-1254	35.000	4.900	12400.0	NA	ug/kg	4.5	6.5
CY40-002	Benzo(a)pyrene	48.000	41.000	3490.0	NA	ug/kg	4.5	6.5
CY40-002	Chrysene	75.000	29.000	3490000.0	NA	ug/kg	4.5	6.5
CY40-002	Fluoranthene	36.000	25.000	272000000.0	NA	ug/kg	4.5	6.5
CY40-002	Pyrene	170.000	140.000	22100000.0	NA	ug/kg	4.5	6.5
CY40-002	Uranium-235	0.191	NA	8.0	0.120	pCi/g	4.5	6.5
CY40-002	Uranium-238	3.717	NA	351.0	1.490	pCi/g	4.5	6.5
CY40-003	Uranium-235	0.210	NA	8.0	0.120	pCi/g	6.5	8.0
CY40-003	Uranium-238	5.497	NA	351.0	1.490	pCi/g	6.5	8.0
CY40-002	2-Methylnaphthalene	57.000	33.000	20400000.0	NA	ug/kg	8.0	10.0
CY40-002	Naphthalene	169.000	5.370	3090000.0	NA	ug/kg	8.0	10.0
CY40-002	Uranium-235	0.220	NA	8.0	0.120	pCi/g	8.0	10.0
CY40-002	Uranium-238	3.547	NA	351.0	1.490	pCi/g	8.0	10.0

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CX40-003	Chrysene	180.000	28.000	3490000.0	NA	ug/kg	0.5	2.5
CX40-003	Pyrene	380.000	130.000	22100000.0	NA	ug/kg	0.5	2.5
CX40-003	Uranium-235	0.161	NA	8.0	0.120	pCi/g	0.5	2.5
CX40-003	Uranium-238	3.666	NA	351.0	1.490	pCi/g	0.5	2.5
CX40-003	Benzo(a)pyrene	85.000	41.000	3490.0	NA	ug/kg	2.5	4.5
CX40-003	Chrysene	84.000	28.000	3490000.0	NA	ug/kg	2.5	4.5
CX40-003	Indeno(1,2,3-cd)pyrene	41.000	23.000	34900.0	NA	ug/kg	2.5	4.5
CX40-003	Pyrene	150.000	140.000	22100000.0	NA	ug/kg	2.5	4.5
CX40-003	Benzo(a)pyrene	53.000	41.000	3490.0	NA	ug/kg	4.5	6.5
CX40-003	Chrysene	57.000	28.000	3490000.0	NA	ug/kg	4.5	6.5
CX40-003	Uranium-235	0.156	NA	8.0	0.120	pCi/g	4.5	6.5
CX40-003	Chromium	82.000	NA	368.0	58.270	mg/kg	8.5	10.5
CX40-003	Uranium-235	0.137	NA	8.0	0.120	pCi/g	12.5	14.5

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CX40-004	Strontium	230.000	NA	613000.0	211.380	mg/kg	2.5	4.5
CX40-004	Americium-241	0.168	NA	76.0	0.020	pCi/g	4.5	6.5
CX40-004	Uranium-238	1.772	NA	351.0	1.490	pCi/g	6.5	8.5

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CZ40-004	Uranium-235	0.185	NA	8.0	0.120	pCi/g	6.5	8.5
CZ40-004	Uranium-238	3.489	NA	351.0	1.490	pCi/g	6.5	8.5
CZ40-004	Uranium-235	0.167	NA	8.0	0.120	pCi/g	8.5	10.5
CZ40-004	Uranium-238	4.189	NA	351.0	1.490	pCi/g	8.5	10.5
CZ40-004	Uranium-235	0.156	NA	8.0	0.120	pCi/g	12.5	14.5

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CZ40-003	Americium-241	132.700	NA	76.0	0.020	pCi/g	0.5	2.5
CZ40-003	Aroclor-1254	46.000	4.800	12400.0	NA	ug/kg	0.5	2.5
CZ40-003	Benzo(a)anthracene	58.000	27.000	34900.0	NA	ug/kg	0.5	2.5
CZ40-003	Benzo(a)pyrene	64.000	44.000	3490.0	NA	ug/kg	0.5	2.5
CZ40-003	Benzo(b)fluoranthene	45.000	31.000	34900.0	NA	ug/kg	0.5	2.5
CZ40-003	Benzo(k)fluoranthene	57.000	35.000	349000.0	NA	ug/kg	0.5	2.5
CZ40-003	Cadmium	2.300	NA	962.0	1.700	mg/kg	0.5	2.5
CZ40-003	Chrysene	70.000	30.000	3490000.0	NA	ug/kg	0.5	2.5
CZ40-003	Fluoranthene	130.000	25.000	272000000.0	NA	ug/kg	0.5	2.5
CZ40-003	Aluminum	39000.000	NA	228000.0	35373.170	mg/kg	2.5	4.5
CZ40-003	Americium-241	122.000	NA	76.0	0.020	pCi/g	2.5	4.5
CZ40-003	Aroclor-1254	39.000	5.300	12400.0	NA	ug/kg	2.5	4.5
CZ40-003	Arsenic	14.000	NA	22.7	13.140	mg/kg	2.5	4.5
CZ40-003	Cadmium	2.900	NA	962.0	1.700	mg/kg	2.5	4.5
CZ40-003	Chrysene	45.000	33.000	3490000.0	NA	ug/kg	2.5	4.5
CZ40-003	Fluoranthene	65.000	27.000	272000000.0	NA	ug/kg	2.5	4.5
CZ40-003	Lithium	44.000	NA	20400.0	34.660	mg/kg	2.5	4.5
CZ40-003	Silver	25.000	NA	5110.0	24.540	mg/kg	2.5	4.5
CZ40-003	Americium-241	17.340	NA	76.0	0.020	pCi/g	4.5	6.5
CZ40-003	Aroclor-1254	36.000	4.500	12400.0	NA	ug/kg	4.5	6.5
CZ40-003	Uranium-235	0.236	NA	8.0	0.120	pCi/g	4.5	6.5
CZ40-003	Uranium-235	0.217	NA	8.0	0.120	pCi/g	6.5	8.5
CZ40-003	Americium-241	0.704	NA	76.0	0.020	pCi/g	8.5	10.5
CZ40-003	Americium-241	0.252	NA	76.0	0.020	pCi/g	12.5	13.5
CZ40-003	Uranium-235	0.398	NA	8.0	0.120	pCi/g	12.5	13.5

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
CZ41-001	Acetone	12.000	5.100	102000000.0	NA	ug/kg	0.5	2.5
CZ41-001	Methylene chloride	3.100	0.890	2530000.0	NA	ug/kg	0.5	2.5
CZ41-001	Plutonium-239/240	0.270	NA	50.0	0.020	pCi/g	0.5	2.5
CZ41-001	Uranium-235	0.200	NA	8.0	0.120	pCi/g	0.5	2.5
CZ41-001	Uranium-238	3.960	NA	351.0	1.490	pCi/g	0.5	2.5
CZ41-001	Methylene chloride	2.900	0.870	2530000.0	NA	ug/kg	2.5	4.5
CZ41-001	Uranium-235	0.208	NA	8.0	0.120	pCi/g	2.5	4.5
CZ41-001	Uranium-238	5.008	NA	351.0	1.490	pCi/g	2.5	4.5
CZ41-001	Acetone	6.100	5.000	102000000.0	NA	ug/kg	4.5	6.5
CZ41-001	Methylene chloride	2.500	0.870	2530000.0	NA	ug/kg	4.5	6.5
CZ41-001	Plutonium-239/240	0.069	NA	50.0	0.020	pCi/g	4.5	6.5
CZ41-001	Uranium-235	0.199	NA	8.0	0.120	pCi/g	4.5	6.5
CZ41-001	Uranium-238	4.403	NA	351.0	1.490	pCi/g	4.5	6.5
CZ41-001	Acetone	6.900	4.900	102000000.0	NA	ug/kg	6.5	8.5
CZ41-001	Methylene chloride	2.900	0.850	2530000.0	NA	ug/kg	6.5	8.5
CZ41-001	Uranium-235	0.152	NA	8.0	0.120	pCi/g	6.5	8.5
CZ41-001	Uranium-238	3.508	NA	351.0	1.490	pCi/g	6.5	8.5
CZ41-001	Acetone	6.400	5.200	102000000.0	NA	ug/kg	8.5	10.5
CZ41-001	Methylene chloride	2.800	0.910	2530000.0	NA	ug/kg	8.5	10.5
CZ41-001	Uranium-238	2.204	NA	351.0	1.490	pCi/g	8.5	10.5

Location code	Analyte	Result	RI	Wrw	Background	Unit	Startdepth	Enddepth
DA41-001	Americium-241	34.330	NA	76.0	0.020	pCi/g	0.5	2.5
DA41-001	Aroclor-1254	150.000	4.900	12400.0	NA	ug/kg	0.5	2.5
DA41-001	Benzo(a)anthracene	46.000	27.000	34900.0	NA	ug/kg	0.5	2.5
DA41-001	Benzo(k)fluoranthene	43.000	35.000	349000.0	NA	ug/kg	0.5	2.5
DA41-001	Chrysene	57.000	31.000	3490000.0	NA	ug/kg	0.5	2.5
DA41-001	Fluoranthene	110.000	25.000	272000000.0	NA	ug/kg	0.5	2.5
DA41-001	Uranium-235	0.291	NA	8.0	0.120	pCi/g	0.5	2.5
DA41-001	Uranium-238	4.328	NA	351.0	1.490	pCi/g	0.5	2.5
DA41-001	Americium-241	21.610	NA	76.0	0.020	pCi/g	2.5	4.5
DA41-001	Aroclor-1254	180.000	4.900	12400.0	NA	ug/kg	2.5	4.5
DA41-001	Fluoranthene	41.000	25.000	272000000.0	NA	ug/kg	2.5	4.5
DA41-001	Uranium-235	0.245	NA	8.0	0.120	pCi/g	2.5	4.5
DA41-001	Uranium-238	5.303	NA	351.0	1.490	pCi/g	2.5	4.5
DA41-001	Uranium-235	0.441	NA	8.0	0.120	pCi/g	4.5	6.5
DA41-001	Uranium-238	1.548	NA	351.0	1.490	pCi/g	6.5	8.5

Figure 3
Trenches T-6, T-8, T-9a, and T-9b
Accelerated Action Characterization
Data Greater Than Background Mean
Plus Two Standard Deviations, or
Reporting Limits

KEY

- Characterization Data with WRW Exceedance
- Characterization Data with Detection below AL

2003 Updated HRR Trench Boundary

2003 Updated HRR IHSS Boundary

Paved road

N
W E
S

100 0 100 Feet

Scale 1: 950

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Date: 4.19.04

RADMS

Prepared for:

KAISER•HILL COMPANY

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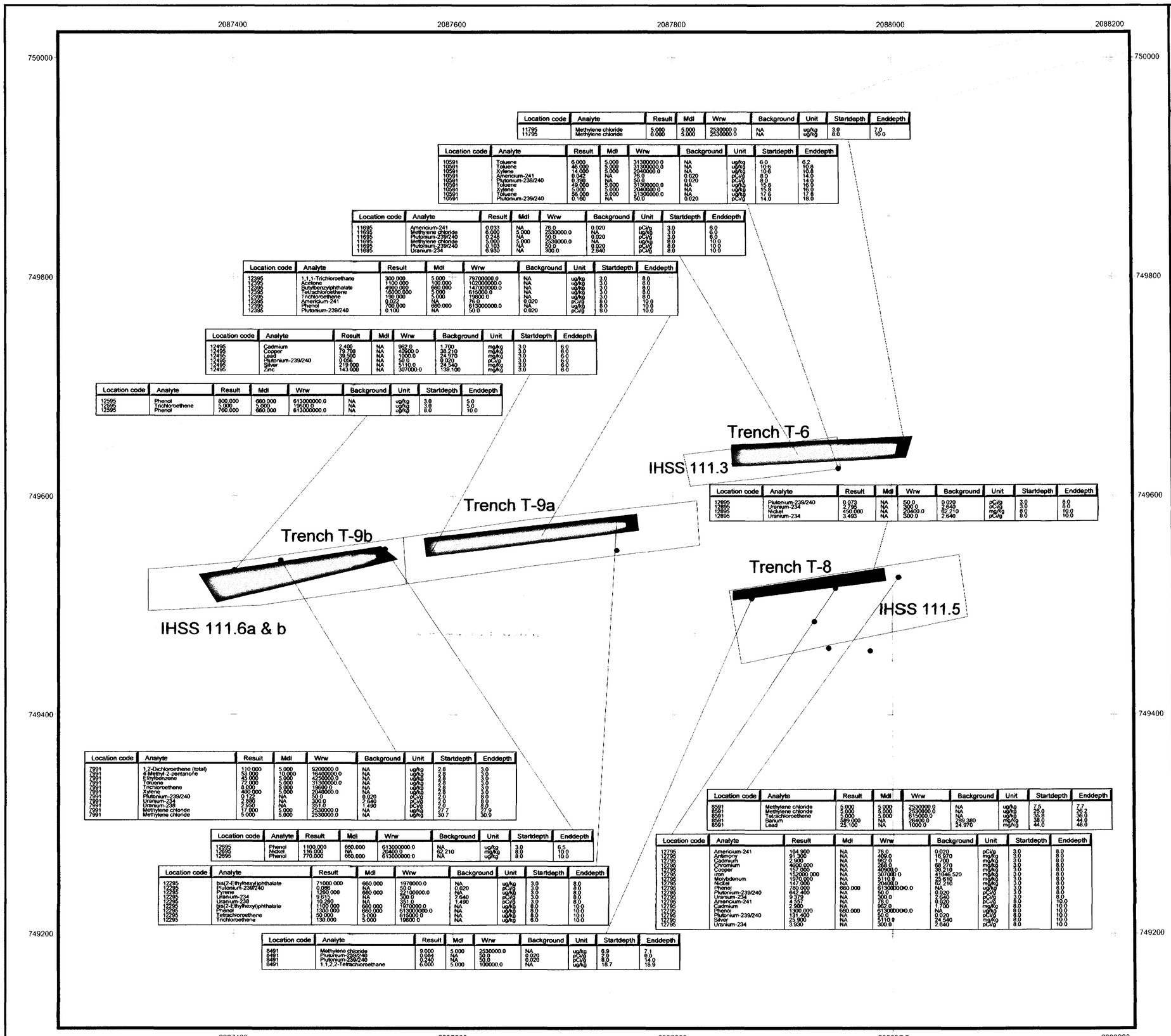
Figure 2
Trenches T-6, T-8, T-9a, and T-9b, Existing Data Greater Than Background Mean Plus Two Standard Deviations, or Method Detection Limits



Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
11795	Methylene chloride	5.000	5.000	2330000.0	NA	ug/kg	3.0	7.0
11795	Methylene chloride	6.000	5.000	2530000.0	NA	ug/kg	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
10591	Toluene	6.000	5.000	31300000.0	NA	ug/kg	6.0	6.2
10591	Toluene	46.000	5.000	31300000.0	NA	ug/kg	10.6	10.8
10591	Xylene	14.000	5.000	20400000.0	NA	ug/kg	10.6	10.8
10591	Americium-241	0.042	NA	76.0	0.020	pCi/g	8.0	14.0
10591	Plutonium-238/240	0.358	NA	50.0	0.020	pCi/g	8.0	14.0
10591	Toluene	49.000	5.000	31300000.0	NA	ug/kg	15.8	16.0
10591	Xylene	5.000	5.000	20400000.0	NA	ug/kg	15.8	16.0
10591	Toluene	56.000	5.000	31300000.0	NA	ug/kg	17.6	17.8
10591	Plutonium-239/240	0.150	NA	50.0	0.020	pCi/g	14.0	18.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
11695	Americium-241	0.033	NA	76.0	0.020	pCi/g	3.0	6.0
11695	Methylene chloride	6.000	5.000	2530000.0	NA	ug/kg	3.0	6.0
11695	Plutonium-239/240	0.246	NA	50.0	0.020	pCi/g	3.0	6.0
11695	Methylene chloride	5.000	5.000	2530000.0	NA	ug/kg	8.0	10.0
11695	Plutonium-239/240	0.103	NA	50.0	0.020	pCi/g	8.0	10.0
11695	Uranium-234	6.930	NA	300.0	2.640	pCi/g	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12395	1,1,1-Trichloroethane	300.000	5.000	79700000.0	NA	ug/kg	3.0	8.0
12395	Acetone	1100.000	100.000	1020000000.0	NA	ug/kg	3.0	8.0
12395	Butylbenzylphthalate	1600.000	660.000	147000000.0	NA	ug/kg	3.0	8.0
12395	Trichloroethene	16000.000	5.000	615000.0	NA	ug/kg	3.0	8.0
12395	Trichloroethene	190.000	5.000	19500.0	NA	ug/kg	8.0	10.0
12395	Americium-241	0.020	NA	76.0	0.020	pCi/g	8.0	10.0
12395	Phenol	1000.000	660.000	613000000.0	NA	ug/kg	8.0	10.0
12395	Plutonium-239/240	0.100	NA	50.0	0.020	pCi/g	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12495	Cadmium	2.400	NA	962.0	1.700	mg/kg	3.0	6.0
12495	Copper	79.700	NA	40600.0	38.210	mg/kg	3.0	6.0
12495	Lead	38.900	NA	1000.0	24.970	mg/kg	3.0	6.0
12495	Plutonium-239/240	0.056	NA	50.0	0.020	pCi/g	3.0	6.0
12495	Silver	219.000	NA	5110.0	24.340	mg/kg	3.0	6.0
12495	Zinc	143.000	NA	307000.0	138.100	mg/kg	3.0	6.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12595	Phenol	800.000	660.000	613000000.0	NA	ug/kg	3.0	5.0
12595	Trichloroethene	5.000	5.000	19500.0	NA	ug/kg	3.0	5.0
12595	Phenol	760.000	660.000	613000000.0	NA	ug/kg	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12895	Plutonium-239/240	0.973	NA	50.0	0.020	pCi/g	3.0	8.0
12895	Uranium-234	2.736	NA	300.0	2.640	pCi/g	3.0	8.0
12895	Nickel	450.000	NA	20400.0	62.210	mg/kg	8.0	10.0
12895	Uranium-234	3.493	NA	300.0	2.640	pCi/g	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
7991	1,2-Dichloroethene (total)	110.000	5.000	9200000.0	NA	ug/kg	2.8	3.0
7991	4-Methyl-2-pentanone	43.000	10.000	163000000.0	NA	ug/kg	2.8	3.0
7991	Ethylbenzene	93.000	5.000	4250000.0	NA	ug/kg	2.8	3.0
7991	Toluene	77.000	5.000	31300000.0	NA	ug/kg	2.8	3.0
7991	Trichloroethene	6.000	5.000	19500.0	NA	ug/kg	2.8	3.0
7991	Xylene	400.000	5.000	20400000.0	NA	ug/kg	2.8	3.0
7991	Plutonium-239/240	0.125	NA	50.0	0.020	pCi/g	2.0	6.0
7991	Uranium-234	2.880	NA	300.0	2.640	pCi/g	2.0	6.0
7991	Uranium-238	0.900	NA	351.0	1.490	pCi/g	2.0	6.0
7991	Methylene chloride	17.000	5.000	2530000.0	NA	ug/kg	27.7	27.9
7991	Methylene chloride	5.000	5.000	2530000.0	NA	ug/kg	30.7	30.9

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12695	Phenol	1100.000	660.000	613000000.0	NA	ug/kg	3.0	6.5
12695	Nickel	116.000	NA	20400.0	62.210	mg/kg	8.0	10.0
12695	Phenol	770.000	660.000	613000000.0	NA	ug/kg	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12295	bis(2-Ethylhexyl)phthalate	71000.000	660.000	1970000.0	NA	ug/kg	3.0	8.0
12295	Plutonium-238/240	0.086	NA	50.0	0.020	pCi/g	3.0	8.0
12295	Pyrene	1200.000	660.000	2310000.0	NA	ug/kg	3.0	8.0
12295	Uranium-234	9.515	NA	300.0	2.640	pCi/g	3.0	8.0
12295	Uranium-238	10.260	NA	351.0	1.490	pCi/g	3.0	8.0
12295	bis(2-Ethylhexyl)phthalate	1100.000	660.000	1970000.0	NA	ug/kg	8.0	10.0
12295	Phenol	1300.000	660.000	613000000.0	NA	ug/kg	8.0	10.0
12295	Tetrachloroethene	50.000	5.000	615000.0	NA	ug/kg	8.0	10.0
12295	Trichloroethene	130.000	5.000	19500.0	NA	ug/kg	8.0	10.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
8491	Methylene chloride	9.000	5.000	2530000.0	NA	ug/kg	6.8	7.1
8491	Plutonium-239/240	0.054	NA	50.0	0.020	pCi/g	8.0	14.0
8491	Plutonium-239/240	0.240	NA	50.0	0.020	pCi/g	8.0	14.0
8491	1,1,2,2-Tetrachloroethane	5.000	5.000	1000000.0	NA	ug/kg	16.7	18.9

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
8581	Methylene chloride	5.000	5.000	2530000.0	NA	ug/kg	7.5	7.7
8581	Methylene chloride	5.000	5.000	2530000.0	NA	ug/kg	35.0	35.2
8581	Tetrachloroethene	5.000	5.000	615000.0	NA	ug/kg	33.8	36.0
8581	Barium	589.000	NA	26400.0	269.380	mg/kg	38.0	44.0
8581	Lead	25.100	NA	1000.0	24.970	mg/kg	44.0	46.0

Location code	Analyte	Result	Mdl	Wrw	Background	Unit	Startdepth	Enddepth
12795	Americium-241	104.900	NA	76.0	0.020	pCi/g	3.0	8.0
12795	Antimony	91.300	NA	409.0	16.970	mg/kg	3.0	8.0
12795	Cadmium	2.900	NA	962.0	1.700	mg/kg	3.0	8.0
12795	Chromium	4600.000	NA	288.0	68.270	mg/kg	3.0	8.0
12795	Copper	157.000	NA	40600.0	38.210	mg/kg	3.0	8.0
12795	Iron	152000.000	NA	307000.0	41046.520	mg/kg	3.0	8.0
12795	Molybdenum	1970.000	NA	5110.0	25.810	mg/kg	3.0	8.0
12795	Nickel	147.000	NA	20400.0	62.210	mg/kg	3.0	8.0
12795	Phenol	780.000	660.000	613000000.0	NA	ug/kg	3.0	8.0
12795	Plutonium-239/240	642.400	NA	50.0	0.020	pCi/g	3.0	8.0
12795	Uranium-234	9.379	NA	300.0	2.640	pCi/g	3.0	8.0
12795	Americium-241	4.247	NA	76.0	0.020	pCi/g	8.0	10.0
12795	Chromium	2.000	NA	288.0	17.700	mg/kg	8.0	10.0
12795	Phenol	1300.000	660.000	613000000.0	NA	ug/kg	8.0	10.0
12795	Plutonium-239/240	131.000	NA	50.0	0.020	pCi/g	8.0	10.0
12795	Silver	23.900	NA	5110.0	24.340	mg/kg	8.0	10.0
12795	Uranium-234	3.930	NA	300.0	2.640	pCi/g	8.0	10.0

KEY

- Sampling location with a Wildlife Refuge Worker (WRW) action level exceedance
- Sampling location with concentrations greater than method detection limits and less than action levels
- Sampling location with concentrations less than method detection limits

2003 Updated HRR Trench Boundary

2003 Updated HRR IHSS Boundary

Paved road

N
W E
S

75 0 75 Feet

Scale 1: 1000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 4.19.04

Prepared by: RADMS

Prepared for: KAISER•HILL COMPANY

File: W:\Projects\Fy2003\Trenches\EastTrenches_092503\sub_trenches.apr

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